



## Technology

# Modeling Using Residuals

### FOR USE WITH LESSON 5-1

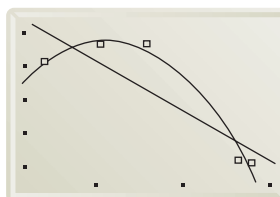
You can use more than one model for a set of data. You can determine which is a better model by analyzing the differences between the  $y$ -values of the data and the  $y$ -values of each model. These differences are called residuals. The better model will have residuals that are closer to zero.

### EXAMPLE

The calculator screen shows the graphs of a linear model and a quadratic model for the data below. Which model better fits the data?

Participation in Baseball in the U.S.

Year (0 = 1900)	87	90	93	98	99
Millions of Participants	15.1	15.5	15.6	12.3	12.1



**Step 1** Press **STAT** **ENTER** to enter the data in  $L_1$  and  $L_2$ . Then use the LinReg and QuadReg features to find linear and quadratic models.

**Step 2** Enter the linear model as  $Y_1$  and the quadratic model as  $Y_2$ .

**Step 3** To find the residuals of the linear model and store the differences in  $L_3$ , enter  $L_2 - \text{VAR} \rightarrow 1 \text{ 1 } ( L_1 ) \text{ STO } L_3 \text{ ENTER}$ .

**Step 4** Find the residuals of the quadratic model. Store the differences in  $L_4$ .

**Step 5** Compare the residuals in  $L_3$  and  $L_4$ . The values in  $L_4$  are closer to zero, so the quadratic model is the better fit.

L2	L3	L4	4
15.1	-.9205	.0409	
15.5	.37034	-.1797	
15.6	1.3612	.25141	
12.3	-.454	-.3816	
12.1	-.357	.26904	
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L4(6) =			

## EXERCISES

For each set of data, find a linear model and a quadratic model. Which model is the better fit? Justify your reasoning.

### 1. Money Spent in the U.S. on Personal Technology

Year (0 = 1970)	0	10	20	22	24	26
Billions of Dollars	8.8	17.6	53.8	61.2	78.5	89.7

### 2. Fishing Licenses Sold

Year (0 = 1970)	0	5	10	15	20	25
Millions Sold	31.1	34.9	35.2	35.7	37.0	37.9